60130-1987
03MRA0008

AMENDMENT

IN THE SPECIFICATION:

Please amend paragraph 3 as follows:

Known disc brakes 10 (shown in Figures 1 to 4) include a disc or rotor 20 mounted to a wheel hub for rotation with a vehicle wheel. A brake carrier 12 is fixed relative to the axis of rotation of the rotor 20 and is secured to a non-rotating portion of the vehicle (e.g. the vehicle suspension). In "floating caliper" type brakes, a brake caliper 15 including a bridge 16 secured to a housing 14 is slidably mounted on the brake carrier 12 to allow for movement parallel to the axis of rotation of the rotor 20. An actuator 18 communicates with one or more pistons or tappets (not shown) provided in the housing 14 to apply the force required for the brake to function.

Please amend paragraph 4 as follows:

A pair of brake pads 22 including friction material 36 mounted to a solid backplate 34 are positioned on either side of the rotor 20. The friction material 36 faces the planar faces of the rotor 20. The backplates 34 of the brake pads 22 are seated on vertical and horizontal abutment regions 28 and 30, respectively, provided in openings 32 in the brake carrier 12 to restrain the brake pads 22 from rotational and radially inward movement, respectively. In a typical "floating caliper" type brake, one of the backplates 34 engages with the piston(s), either directly or via a spreader plate, to distribute the load. The actuator 18 causes the piston to push one of the brake pads 22 towards the rotor 20 to achieve braking. Because the caliper is able to "float" on the brake carrier 12, an equal frictional braking load is applied by both brake pads 22.

Please amend paragraph 5 as follows:

The backplates 34 of vehicle disc brake pads 22 perform two functions. First, the brake pads 22 provide a solid support for slidably mounting the friction material 36 of the brake within the brake carrier 12 to transmit the shear loads induced on the friction material 36 during braking to the brake carrier 12. Second, the brake pads 22 transmit and evenly distribute the pressure applied by the brake tappets or the pistons during braking to the surface of the friction material 36 to ensure even wear of the friction material 36. To perform the functions, resilient members (such as a leaf type pad springs 24) are commonly used to restrain radially outward movement (indicated by arrow R) of the brake pads 22 in the brake carrier 12 while permitting movement towards and away (indicated by arrow A) from an associated brake disc and to prevent rattling of the brake pad 22 in use.

Please amend paragraph 6 as follows:

The pad springs 24 are typically elongate and, when fitted, extend along a portion of the radially outermost face of the backplate 34. The pad springs 24 are typically pre-loaded to a certain extent against the brake carrier 12 by a pad retainer 26, which spans an opening between the bridge 16 and the housing 14 and contacts the approximate center of the pad spring 24. This force is typically reacted radially outwardly by contact of the backplate 34 with each end of the pad spring 24. Formations are also typically provided on the backplate 34 and/or the pad spring 24 to retain the pad spring 24 on the backplate 34 during movement of the brake pad 22 parallel to the axis of rotation of the rotor [[14]]20.

Please amend paragraph 24 as follows:

As further shown in Figures 5 and 6, ~~the~~a pad spring 124 is elongate and has a length L, a central portion 148 in the middle of the length L of the pad spring 124, and end regions 149. The central portion 148 defines a maximum width W2 of the pad spring 124, and the remainder of the pad spring 124 has a reduced width W1. The pad spring 124 is stamped from sheet metal and is typically 1 mm thick.

Please amend paragraph 26 as follows:

As shown in Figure 6, the upturned ends 142 are spaced slightly from the associated abutment 140 when installed. Similarly, the circumferential ends of each slot 152 are spaced slightly from the associated lug 150. In the prior art, as shown in Figure 3, the spring ends 42 are in permanent engagement with their respective abutment 40 when installed, reducing the tendency of the pad spring 24 to tip relative to the backplate 34. An equivalent feature is not found on the disc brake pad assembly 133 of the present invention. Therefore, the present invention is particularly applicable to backplates 134 having the lugs 150 that project through the ~~holes~~slots 152 in the pad spring 124 since these designs are inherently more prone to the tipping of the pad spring 124 relative to the brake pad 131.

Please amend paragraph 28 as follows:

As shown in Figure 8, a radially inner surface 127 of a pad retainer 126 abuts and holds down the central portion 148 of the pad spring 124. The inner surface 127 is substantially planar. The area of the pad spring 124 in contact with ~~the~~a pad retainer 126 defines a pad spring surface 170. The pad spring surface 170 is defined by a profile having a substantially planar section 180 and two rounded edges 171 of radius Q. The rounded edges 171 are symmetrical, allowing the pad spring 124 to be fitted either way around on the brake pad 131 while ensuring a rounded edge 171 is adjacent a bend 126A. Alternately, the profile could be elliptical.

Please amend paragraph 29 as follows:

Typically, the pad spring 124 is formed from sheet metal, typically steel or spring steel. A blank is stamped from sheet metal. The sheet metal either including holes 152 or alternatively, the ~~holes~~slots 152 are stamped at a later stage. Subsequent pressing operations are then performed on the blank to form the requisite final shape. Preferably, the rounded edges 171 are formed as part of the pressing process.

Please amend paragraph 30 as follows:

The pad retainer 126 is secured to an outboard end 189 of the brake caliper 115 by a securing feature, such as a bolt 173. The dotted line ~~177~~ in Figure 7 shows the inside wheel profile 177 of the wheel to which the disc brake assembly 129 is fitted. The space between the disc brake assembly 129, in particular between the pad retainer 126 and the wheel profile 177, is restricted. The pad retainer 126 mounted on the brake caliper 115 is shaped to locate within the space provided. The radius of the inner surface 127 of the pad retainer 126 is R1, and the radius of the ~~securing feature~~bolt 173 is R2, which is less than R1 because of the space envelope. Both radii have a center at the wheel axis, which is indicated by P. To accommodate the location of the ~~securing feature~~bolt 173 on the brake caliper 115, the pad retainer 126 includes a crook in the form of ~~a~~the bend 126A. The bend 126A has a radius T substantially equal to the radius Q of the rounded edge 171 of the pad spring surface 170. In this embodiment, T and Q are between 5.25 mm and 6.75 mm. However, this range can be widened. In particular, the bend 126A accommodates the fact that the bolt 173 has a smaller radius than the inner surface 127. The pad retainer 126 further includes a second bend 126B.

Please amend paragraph 32 as follows:

Before the pad spring 124 is fitted onto the lugs 150, the pad spring 124 has an arcuate profile with a radius of curvature shorter than shown in Figure 6. To fit the pad spring 124 to the backplate 134, it must be compressed by a certain amount for the slots 152 to fit over both the lugs 150. Once fitted, a certain amount of relaxation occurs such that the circumferentially outermost edge of the slots 152 contact the radially outermost face of the lugs 150, retaining the pad spring 124 on the backplate 134 before mounting of the disc brake pad assembly 133 in the disc brake 10. In other embodiments, the lugs 150 may not perform this circumferential retaining function.

Please amend paragraph 33 as follows:

Figure 6 illustrates the disc brake pad assembly 133 when assembled on the disc brake 10 with the pad retainer 126 in place. The pad retainer 126 depresses the central portion 148 of the pad spring 124 such that the circumferentially outermost edges of the slots 152 no longer contact the lugs 150, creating a space between the circumferentially innermost edges of the ~~holes~~slots 152 and the lugs 150.

Please amend paragraph 34 as follows:

When the backplate 134 is subjected to radially outward accelerative loads (for example, due to a vehicle traveling over uneven terrain), the loads decrease the distance S between the pad retainer 126 and the central region 144 of the backplate 134. This causes the pad spring 124 to straighten along its length L and the upturned ends 142 to slide circumferentially outwardly upward until they contact the abutments 140. Further deflections towards the radially ~~outermost~~outer face 135 of the backplate 134 up to the position 166 have a significantly higher spring rate due to the pad spring 124 entering an elastic "buckling" mode of deflection in which the central portion 148 continues to straighten, but the portions intermediate the central portion 148 and the upturned ends 142 are forced to curve away from the radially outer face 135.

Please amend paragraph 35 as follows:

During radial movement as described above, the central portion 148 of the pad spring 124 and the pad retainer 126 are in contact over the pad spring surface 170, and the pad retainer 126 restrains radial movement of the brake pad 131.

Please amend paragraph 36 as follows:

Actuation of the brakes moves the brake pad 131 toward the rotor in direction A and moves the pad spring 124 relative to the pad retainer 126. The rounded edge 171 profile of the pad spring 124 ensures that even when the pad spring surface 170 and the pad retainer 126 are not parallel, the rounded edge 171 does not indent into the pad retainer 126. Therefore, movement of the pad spring 124 is not inhibited and braking performance is not affected.

Please amend paragraph 37 as follows:

It should be understood that numerous changes may be made within the scope of the present invention. For example, alternative means of securing the pad spring 124 to the backplate 134 may be employed, and other suitable shapes of the ~~pad spring end~~rounded edge 171 and the abutment 140 (e.g., such as inwardly curved or straight ends) can be employed. The circumferential restraint does not need to occur at the extreme ends of the pad spring 124. For example, the abutments 140 for providing circumferential restraint may be the circumferential inner faces of the lugs 150 which restrain the circumferentially inner edges of the slots 152.